

# TCS IPA Infrastructure & Cloud Computing Study Guide

Data Centre, Storage, Database, Virtualization, Backup, Security, Cloud, Monitoring & Office 365

## Topic 1: Data Centre Fundamentals

### What is a Data Centre?

**Definition:** A facility that houses computer systems, servers, networking equipment, and storage systems to support IT operations.

**Think of it like:** A massive warehouse full of computers working 24/7 to power websites, apps, and digital services.

### Key Components of Data Centre

Component	Purpose	Examples
Servers	Process applications and data	Dell PowerEdge, HP ProLiant
Storage	Store data permanently	SAN, NAS, Cloud Storage
Networking	Connect all components	Switches, Routers, Firewalls
Power Systems	Provide reliable electricity	UPS, Generators, PDUs
Cooling	Prevent overheating	HVAC, Liquid cooling
Security	Physical protection	Access cards, CCTV, Guards

### Data Centre Tiers (Availability Levels)

Tier	Availability	Downtime/Year	Features
Tier I	99.671%	28.8 hours	Basic infrastructure
Tier II	99.741%	22.0 hours	Redundant components
Tier III	99.982%	1.6 hours	Concurrently maintainable
Tier IV	99.995%	0.4 hours	Fault tolerant

### Common Data Centre Services

- **Colocation** - Rent space for your servers
- **Managed Hosting** - Provider manages your infrastructure
- **Cloud Services** - Virtual resources on-demand
- **Disaster Recovery** - Backup location for emergencies

# MCQ Pattern Example

Q: Which data centre tier provides fault tolerance with 99.995% availability?

- A) Tier I
- B) Tier II
- C) Tier III
- **D) Tier IV ✓**

## Topic 2: Storage Systems

### What is Storage?

**Definition:** Hardware and software systems that store, organize, and provide access to data.

### Types of Storage

#### Based on Connection Method

Type	Full Form	Description	Use Case
<b>DAS</b>	Direct Attached Storage	Connected directly to server	Small offices
<b>NAS</b>	Network Attached Storage	File-level storage over network	File sharing
<b>SAN</b>	Storage Area Network	Block-level storage network	<b>Enterprise databases</b>

#### Based on Storage Medium

Type	Description	Speed	Cost	Use Case
<b>HDD</b>	Hard Disk Drive	Slow	Low	Bulk storage, backups
<b>SSD</b>	Solid State Drive	<b>Fast</b>	Medium	OS, applications
<b>NVMe</b>	Non-Volatile Memory Express	<b>Fastest</b>	High	High-performance databases

### Storage Protocols

- **SATA** - Consumer drives
- **SAS** - Enterprise drives
- **iSCSI** - Storage over IP network
- **Fibre Channel** - High-speed SAN
- **NFS/CIFS** - Network file sharing

## RAID Levels (Redundant Array of Independent Disks)

RAID Level	Description	Minimum Disks	Fault Tolerance
RAID 0	Striping (speed)	2	None
RAID 1	Mirroring (backup)	2	1 disk failure
RAID 5	Striping + Parity	3	1 disk failure
RAID 6	Double parity	4	2 disk failures
RAID 10	Mirror + Stripe	4	Multiple failures

## Key Storage Concepts

- **Capacity** - How much data can be stored
- **IOPS** - Input/Output Operations Per Second (performance)
- **Throughput** - Data transfer rate (MB/s)
- **Latency** - Access delay time

## MCQ Example

*Q: Which RAID level provides both performance and fault tolerance with minimum 3 disks?*

- A) RAID 0
- B) RAID 1
- **C) RAID 5 ✓**
- D) RAID 6

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## Topic 3: Database Fundamentals

### What is a Database?

**Definition:** Organized collection of structured data stored electronically for easy access, management, and updating.

### Types of Databases

#### Based on Data Model

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Type	Description	Examples	Best For
Relational (SQL)	Tables with relationships	MySQL, PostgreSQL, Oracle	Traditional applications
NoSQL	Non-relational, flexible	MongoDB, Cassandra	Big data, web apps
Graph	Nodes and relationships	Neo4j, Amazon Neptune	Social networks
Time-series	Time-stamped data	InfluxDB, TimescaleDB	IoT, monitoring

Based on Deployment

Type	Description	Pros	Cons
On-premises	Hosted locally	Full control	High maintenance
Cloud	Hosted by provider	Scalable, managed	Dependency on internet
Hybrid	Mix of both	Flexibility	Complex management

Popular Database Systems

SQL Databases

- **MySQL** - Open source, web applications
- **PostgreSQL** - Advanced open source
- **Oracle** - Enterprise-grade
- **SQL Server** - Microsoft ecosystem
- **SQLite** - Lightweight, embedded

NoSQL Databases

- **MongoDB** - Document database
- **Redis** - In-memory cache
- **Cassandra** - Distributed database
- **DynamoDB** - Amazon's NoSQL

Database Operations (CRUD)

- **Create** - Insert new data
- **Read** - Query/retrieve data
- **Update** - Modify existing data
- **Delete** - Remove data

Database Roles

- **DBA** - Database Administrator (manages database)
- **Developer** - Creates applications using database
- **Analyst** - Analyzes data for insights

## MCQ Example

*Q: Which type of database is best suited for handling unstructured data in web applications?*

- A) SQL
  - **B) NoSQL ✓**
  - C) Graph
  - D) Time-series
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## Topic 4: Virtualization

### What is Virtualization?

**Definition:** Technology that creates virtual versions of physical resources (servers, storage, networks) to maximize hardware utilization.

**Think of it like:** One physical computer acting as multiple separate computers.

### Types of Virtualization

#### Server Virtualization

Type	Description	Use Case
Type 1 (Bare Metal)	Hypervisor runs directly on hardware	Data centers
Type 2 (Hosted)	Hypervisor runs on host OS	Development/Testing

#### Other Virtualization Types

- **Desktop Virtualization** - Virtual desktops (VDI)
- **Application Virtualization** - Apps run without installation
- **Network Virtualization** - Virtual networks (SDN)
- **Storage Virtualization** - Abstract storage resources

### Popular Hypervisors

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Type	Hypervisor	Vendor	Best For
Type 1	VMware vSphere	VMware	Enterprise
Type 1	Hyper-V	Microsoft	Windows environments
Type 1	KVM	Linux	Open source
Type 2	VMware Workstation	VMware	Development
Type 2	VirtualBox	Oracle	Personal use

Virtualization Benefits

- **Cost Reduction** - Less physical hardware needed
- **Resource Optimization** - Better hardware utilization
- **Scalability** - Easy to add/remove VMs
- **Disaster Recovery** - Easy backup and restore
- **Testing** - Safe isolated environments

Key Virtualization Terms

- **VM** - Virtual Machine
- **Hypervisor** - Software that creates VMs
- **Host** - Physical machine running hypervisor
- **Guest** - Virtual machine running on host
- **Snapshot** - Point-in-time VM backup

Container vs Virtual Machine

Feature	Virtual Machine	Container
OS	Full OS per VM	Shared host OS
Size	Large (GBs)	Small (MBs)
Startup	Slow (minutes)	Fast (seconds)
Isolation	Strong	Process-level
Use Case	Different OS needs	Microservices

Popular Container Platforms

- **Docker** - Container runtime
- **Kubernetes** - Container orchestration
- **OpenShift** - Enterprise container platform

## MCQ Example

Q: Which hypervisor type runs directly on physical hardware?

- **A) Type 1 (Bare Metal) ✓**
- B) Type 2 (Hosted)
- C) Container
- D) Application

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## Topic 5: Backup & Restore

### What is Backup?

**Definition:** Process of creating copies of data to protect against data loss, corruption, or disasters.

### Types of Backup

#### Based on Data Selection

Type	Description	Speed	Storage Needed
Full Backup	Complete copy of all data	Slow	<b>Most space</b>
Incremental	Only changed data since last backup	<b>Fastest</b>	Least space
Differential	Changed data since last full backup	Medium	Medium space

#### Based on Location

Type	Description	Pros	Cons
Local Backup	On-site storage	Fast access	<b>Risk of local disasters</b>
Remote Backup	Off-site storage	<b>Disaster protection</b>	Slower access
Cloud Backup	Internet-based	Scalable, managed	Internet dependency

### Backup Strategies

#### 3-2-1 Rule (Industry Standard)

- **3** copies of important data
- **2** different storage media types
- **1** copy stored off-site

#### Grandfather-Father-Son (GFS)

- **Daily** backups (Son)
- **Weekly** backups (Father)
- **Monthly** backups (Grandfather)

## Backup Technologies

- **Tape Backup** - Traditional, long-term storage
- **Disk Backup** - Faster access, higher cost
- **Cloud Backup** - Amazon S3, Google Cloud
- **CDP** - Continuous Data Protection (real-time)

## Recovery Concepts

### Recovery Metrics

- **RTO** - Recovery Time Objective (how long to restore)
- **RPO** - Recovery Point Objective (how much data loss acceptable)

### Recovery Types

- **Disaster Recovery** - Complete system restoration
- **Point-in-time Recovery** - Restore to specific moment
- **Bare Metal Recovery** - Restore to new hardware

## Common Backup Software

- **Veeam** - VM backup specialist
- **Commvault** - Enterprise backup
- **Acronis** - Disk imaging
- **Windows Backup** - Built-in Windows tool

## MCQ Example

*Q: According to the 3-2-1 backup rule, how many copies of data should be stored off-site?*

- **A) 1** ✓
  - B) 2
  - C) 3
  - D) 4
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# Topic 6: Security Fundamentals

## What is IT Security?

**Definition:** Protection of computer systems, networks, and data from theft, damage, or unauthorized access.

## CIA Triad (Core Security Principles)

Principle	Definition	Example
Confidentiality	Data accessible only to authorized users	Encryption, access controls
Integrity	Data remains accurate and unaltered	Digital signatures, checksums
Availability	Systems accessible when needed	Redundancy, disaster recovery

## Types of Security Threats

### Malware Types

Type	Description	Example
Virus	Self-replicating code	Boot sector virus
Worm	Spreads across networks	Conficker worm
Trojan	Disguised malicious software	Banking trojans
Ransomware	Encrypts data for money	WannaCry
Spyware	Secretly monitors activity	Keyloggers

### Attack Types

- **Phishing** - Fake emails to steal credentials
- **DDoS** - Overwhelming servers with traffic
- **Man-in-the-Middle** - Intercepting communications
- **SQL Injection** - Database attacks via web forms
- **Social Engineering** - Manipulating people

## Security Controls

### Physical Security

- **Access cards** - Control building entry
- **CCTV** - Monitor facilities

- **Biometrics** - Fingerprint, face recognition
- **Security guards** - Human oversight

## Network Security

- **Firewall** - Filter network traffic
- **IDS/IPS** - Intrusion Detection/Prevention
- **VPN** - Secure remote connections
- **NAC** - Network Access Control

## Data Security

- **Encryption** - Scramble data (AES, RSA)
- **Access Control** - User permissions
- **Data Loss Prevention** - Monitor data movement
- **Backup** - Protect against data loss

## Authentication Methods

Method	Description	Security Level
Something you know	Password, PIN	Low
Something you have	Smart card, token	Medium
Something you are	Biometrics	High
Multi-Factor (MFA)	Combination of above	Highest

## Security Frameworks

- **ISO 27001** - Information security management
- **NIST** - US government standard
- **COBIT** - IT governance framework
- **PCI DSS** - Payment card security

## MCQ Example

*Q: Which type of malware encrypts user files and demands payment for decryption?*

- A) Virus
- B) Worm
- C) Trojan

- D) Ransomware ✓

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## Topic 7: Cloud Computing

### What is Cloud Computing?

**Definition:** On-demand delivery of computing services (servers, storage, databases, networking) over the internet.

**Think of it like:** Using electricity from the power grid instead of generating your own power.

### Cloud Service Models

Model	Full Form	What You Get	What You Manage
IaaS	Infrastructure as a Service	Virtual machines, storage	OS, applications, data
PaaS	Platform as a Service	Development platform	Applications, data
SaaS	Software as a Service	Ready-to-use applications	Just use the service

### Cloud Deployment Models

Model	Description	Who Uses It
Public Cloud	Shared infrastructure	Small to medium businesses
Private Cloud	Dedicated infrastructure	Large enterprises, government
Hybrid Cloud	Mix of public and private	Most enterprises
Multi-Cloud	Multiple cloud providers	Risk mitigation

### Major Cloud Providers

#### Amazon Web Services (AWS)

- **EC2** - Virtual servers
- **S3** - Object storage
- **RDS** - Managed databases
- **Lambda** - Serverless functions

#### Microsoft Azure

- **Virtual Machines** - Compute instances
- **Blob Storage** - Object storage
- **SQL Database** - Managed SQL

- **Azure Functions** - Serverless

## Google Cloud Platform (GCP)

- **Compute Engine** - Virtual machines
- **Cloud Storage** - Object storage
- **Cloud SQL** - Managed databases
- **Cloud Functions** - Serverless

## Cloud Benefits

- **Cost Efficiency** - Pay for what you use
- **Scalability** - Easy to scale up/down
- **Flexibility** - Access from anywhere
- **Reliability** - High availability
- **Security** - Enterprise-grade protection

## Cloud Challenges

- **Internet Dependency** - Need reliable connectivity
- **Data Privacy** - Data stored elsewhere
- **Vendor Lock-in** - Difficult to switch providers
- **Compliance** - Regulatory requirements

## Cloud Migration Strategies (6 R's)

1. **Rehost** - Lift and shift
2. **Replatform** - Lift, tinker, and shift
3. **Refactor** - Re-architect for cloud
4. **Repurchase** - Move to SaaS
5. **Retain** - Keep on-premises
6. **Retire** - Decommission

## MCQ Example

*Q: In which cloud service model does the customer only manage applications and data?*

- A) IaaS
- **B) PaaS** ✓

- C) SaaS
  - D) DaaS
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## Topic 8: Monitoring Tools

### What is IT Monitoring?

**Definition:** Continuous observation of IT infrastructure, applications, and services to ensure optimal performance and availability.

### Types of Monitoring

#### Infrastructure Monitoring

- **Server Monitoring** - CPU, memory, disk usage
- **Network Monitoring** - Bandwidth, latency, packet loss
- **Storage Monitoring** - Capacity, IOPS, throughput
- **Database Monitoring** - Query performance, connections

#### Application Monitoring

- **APM** - Application Performance Monitoring
- **User Experience** - Response times, errors
- **Business Metrics** - Transactions, revenue impact

### Popular Monitoring Tools

#### Open Source

Tool	Purpose	Best For
Nagios	Infrastructure monitoring	Traditional IT
Zabbix	Network monitoring	Large networks
Prometheus	Metrics collection	Kubernetes, containers
Grafana	Data visualization	Dashboards
ELK Stack	Log management	Log analysis

#### Commercial

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Tool	Vendor	Purpose
SCOM	Microsoft	Windows environments
SolarWinds	SolarWinds	Network monitoring
Datadog	Datadog	Cloud monitoring
New Relic	New Relic	APM
Splunk	Splunk	Log analytics

## Key Monitoring Metrics

### Server Metrics

- **CPU Utilization** - Processor usage %
- **Memory Usage** - RAM consumption
- **Disk I/O** - Read/write operations
- **Network Traffic** - Bytes in/out

### Application Metrics

- **Response Time** - How fast app responds
- **Throughput** - Requests per second
- **Error Rate** - % of failed requests
- **Availability** - Uptime percentage

## Monitoring Concepts

- **Threshold** - Alert trigger point
- **Baseline** - Normal performance level
- **SLA** - Service Level Agreement
- **MTTR** - Mean Time To Resolution
- **MTBF** - Mean Time Between Failures

## Alert Management

- **Severity Levels** - Critical, Warning, Info
- **Escalation** - Alert routing based on severity
- **Notification Methods** - Email, SMS, Slack
- **Alert Fatigue** - Too many false alarms

## MCQ Example

Q: Which monitoring tool is primarily used for creating dashboards to visualize metrics?

- A) Nagios
  - B) Prometheus
  - **C) Grafana ✓**
  - D) Zabbix
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## Topic 9: Office 365 (Microsoft 365)

### What is Office 365?

**Definition:** Microsoft's cloud-based productivity suite that includes email, document creation, collaboration tools, and business applications.

**Current Name:** Microsoft 365 (rebranded from Office 365)

### Core Applications

#### Productivity Apps

Application	Purpose	Key Features
Word Online	Document creation	Real-time collaboration
Excel Online	Spreadsheets	Formulas, charts, pivot tables
PowerPoint Online	Presentations	Templates, animations
Outlook	Email and calendar	<b>Exchange Online backend</b>
OneNote	Note-taking	

#### Collaboration Tools

Tool	Purpose	Key Features
Teams	Video meetings, chat	<b>Integration with all apps</b>
SharePoint	Document management	Version control, workflows
OneDrive	File storage	<b>1TB storage per user</b>
Yammer	Enterprise social network	Company-wide communication

### Office 365 Plans

#### Business Plans

Plan	Users	Key Features	Price Range
Business Basic	Up to 300	Web apps, Teams, 1TB storage	Cheapest
Business Standard	Up to 300	Desktop apps + web apps	Most popular
Business Premium	Up to 300	Advanced security features	Full-featured

## Enterprise Plans

- **E1** - Web apps only, enterprise features
- **E3** - Desktop apps, advanced compliance
- **E5** - Full features, advanced analytics

## Key Benefits

- **Always Updated** - Latest features automatically
- **Anywhere Access** - Work from any device
- **Collaboration** - Real-time document editing
- **Security** - Enterprise-grade protection
- **Scalability** - Easy to add/remove users

## Admin Features

- **Admin Center** - Centralized management
- **User Management** - Add/remove users, assign licenses
- **Security & Compliance** - Data loss prevention, encryption
- **Reports** - Usage analytics
- **Mobile Device Management** - Control mobile access

## Integration Capabilities

- **Active Directory** - Single sign-on
- **Third-party Apps** - Salesforce, Adobe
- **Power Platform** - PowerBI, PowerApps
- **Azure** - Cloud services integration

## Common Use Cases

- **Remote Work** - Distributed teams
- **Document Collaboration** - Multiple authors



- **Video Conferencing** - Teams meetings
- **Email Migration** - From on-premises Exchange
- **File Sharing** - Replace file servers

## Security Features

- **Multi-Factor Authentication** - Extra login security
- **Data Loss Prevention** - Prevent sensitive data leaks
- **Advanced Threat Protection** - Email security
- **Information Rights Management** - Document protection
- **Compliance Center** - Meet regulatory requirements

## MCQ Example

*Q: Which Office 365 application is primarily used for document management and collaboration?*

- A) Teams
  - B) OneDrive
  - **C) SharePoint ✓**
  - D) Yammer
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## Quick Revision Summary

### Key Concepts by Topic

#### Data Centre

- **Tiers I-IV** (availability levels)
- **Components:** Servers, storage, networking, power, cooling
- **Services:** Colocation, managed hosting, cloud

#### Storage

- **Types:** DAS, NAS, SAN
- **Media:** HDD, SSD, NVMe
- **RAID:** 0, 1, 5, 6, 10

#### Database

- **SQL vs NoSQL**

- **Popular:** MySQL, MongoDB, Oracle
- **Operations:** CRUD (Create, Read, Update, Delete)

## Virtualization

- **Type 1** (bare metal) vs **Type 2** (hosted)
- **Popular:** VMware, Hyper-V, Docker, Kubernetes
- **Containers vs VMs**

## Backup & Restore

- **Types:** Full, Incremental, Differential
- **3-2-1 Rule:** 3 copies, 2 media, 1 off-site
- **Metrics:** RTO, RPO

## Security

- **CIA Triad:** Confidentiality, Integrity, Availability
- **Threats:** Malware, phishing, DDoS
- **Controls:** Physical, network, data security

## Cloud Computing

- **Service Models:** IaaS, PaaS, SaaS
- **Deployment:** Public, private, hybrid
- **Providers:** AWS, Azure, GCP

## Monitoring

- **Tools:** Nagios, Grafana, Prometheus
- **Metrics:** CPU, memory, response time
- **Types:** Infrastructure, application monitoring

## Office 365

- **Apps:** Word, Excel, Teams, SharePoint
- **Plans:** Business Basic/Standard/Premium, Enterprise E1/E3/E5
- **Features:** Collaboration, security, mobility

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## Final Exam Tips

## Common MCQ Patterns

- **"Which tier provides highest availability?"** → Tier IV
- **"Best storage for high-performance databases?"** → SAN
- **"Which hypervisor runs directly on hardware?"** → Type 1
- **"What does SaaS provide?"** → Ready-to-use applications
- **"Which backup type needs least storage?"** → Incremental
- **"Core principles of security?"** → CIA Triad

## Study Strategy

1. **Understand concepts** before memorizing
2. **Compare similar technologies** (SAN vs NAS, Type 1 vs Type 2)
3. **Remember key numbers** (Tier availability, RAID levels)
4. **Practice scenarios** (Which solution for what problem?)
5. **Focus on popular technologies** (VMware, AWS, Office 365)

**Good luck with your TCS IPA exam!** 🚀